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An avifaunal survey of Mt Kulal, Kenya

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Mt Kulal, in northern Kenya, lies in one of the of the most arid and hostile parts of the country. Nonetheless there is a small area of montane forest on the mountain top, completely isolated from other forest patches (the nearest of these, on Mt Njiru, is some 55 km away across semi-desert). This forest constitutes an inland island, the only refuge of an endemic form of white-eye. This is treated by some authors as a subspecies of Montane White-eye *Zosterops poliogaster* (Dowsett & Dowsett-Lemaire 1993), and by others as a full species *Zosterops kulalensis* (Collar *et al.* 1994, BirdLife International 2000). A short report on Kulal's avifauna, unfortunately based on an incomplete and partly erroneous species list, was published by Moreau (1966). After this, the forest was visited briefly by Diamond & Keith (1980) in 1962 and 1979 and by some other observers whose records were included in the Bird Atlas of Kenya (Lewis & Pomeroy 1989). These data provided a good initial list of the bird species of the forest, estimated at 51–75% complete by Bennun & Waiyaki (1993). However, no clear information is available on the structure of the bird community, on its variation over time, and on its present conservation status (considered worrying by Diamond & Keith (1980), owing to the growing human pressure on the area).

We report the results of a survey carried out in 1997–98 that aimed to provide basic information on the avifauna of Mt Kulal, focusing especially on the forest habitat. These data form a basis for further comparisons with other East African forests.

The study site

Mt Kulal (2°43'N 36°56' E) is an extinct Pleistocene volcano in northern Kenya, east of the southern end of Lake Turkana (Figure 1). It rises steeply to an altitude of 2230 m. The surrounding area is mainly below 750 m, with sparse rainfall (between 200 and 300 mm/year). The upper part of the mountain enjoys a substantially wetter climate, with an average rainfall of 900–1000 mm/year (Bake 1983), allowing forest to develop. Based on the available 1:100,000 maps (Survey of Kenya, series Y633, sheet 41), the forest covers approximately 18 km², divided into a larger southern section (c. 12 km²) and a smaller northern one (6 km²). The two sections of forest are separated by the remains of a crater and surrounded by a belt of drier bushland, bringing the total extent of evergreen vegetation on the mountain to about 30–40 km².

The area is inhabited by the Samburu people, nomadic pastoralists who usually enter the forest only to allow their animals to graze in the dry season. Apart from this, the forest is also exploited as a source of fuelwood and wild honey. Large mammals, such as African Elephant *Loxodonta africana* and Cape Buffalo *Syncerus caffer* were exterminated in the early 1970s.

We visited the area between 20 November and 17 December 1997 and between 13 and 28 October 1998. In 1997 we were based in the small village of Gatab, at an altitude of 1750 m on the southern slope of the mountain, from which only the southern part of the forest was accessible. In 1998 we spent eight days (13–20 October) at Gatab again. We then proceeded to Toora (2100 m), in the northern section of the forest, where we camped from 23–28 October.

The weather was very different in the two years. In 1997 the area was extremely wet, and temperatures lower than usual. By contrast, in 1998 there had been no rain since June, and almost none fell during our stay.

Our main aim was to survey the habitats above 1500 m of altitude, and especially the forest, which usually grows above 1800 m. The following habitat categories were recognised:

Forest: habitats with continuous or almost continuous canopy exceeding 8 m, dominated by trees (defined as woody plants of more than 3 m of height) with diameters at breast height of more than 5 cm, and usually a medium or low density of shrubs (vegetation of 1–3 m in height). Common tree species included *Cassipourea malosana, Olea hochstetteri, Xymalos monospora, Teclea simplicifolia* and *T. nobilis*. *Juniperus procera* and *Olea europaea* were also present, but usually in the outer and most disturbed parts of the forest.

Forest edge: habitats with a discontinuous canopy mostly lower than 8 m, with a high cover of shrubs. Trees were mostly of less than 5 cm in diameter. Common tree and shrub species were *Olea europaea, Juniperus procera, Pistacia aethiopica* and *Cadia purpurea*.

Wet bush: habitats with few or no trees, dominated by shrubs, with many evergreen species, usually at altitudes of 1500–1800 m. Common plant species were *Cadia purpurea, Acacia brevispica, Carissa edulis, Myrsine africana* and *Euclea* spp.

Dry bush: usually at altitudes lower than 1600 m, with several species of *Acacia* and other deciduous plants. We spent less time in this habitat than in the others and birds were recorded only through casual observation.

Man-made habitats: this category included grass meadows used as pastures, cultivated fields and villages. In this habitat too, birds were only recorded by casual observation.

Methods

We surveyed birds using mist-netting, fixed-radius point counts (Bibby *et al.* 1992) and casual observations.

We mist-netted at six sites (Figure 1). We used 12-m, four panel, 16-mm mesh nets. Table 1 gives a summary of mist-netting effort. We ringed at sites 3 and 5 in both years. The presence of brood patches was recorded on a scale ranging from 0 (no brood patch) to 3 (large brood patch).

An attempt was made to locate the point counts randomly by walking along a straight line with the help of a compass. One point count was carried out after exactly 6 minutes of walking. However, when dense vegetation or natural obstacles did not allow us to cover a distance of at least 200 m from the preceding point, another 6 minutes were walked before stopping.

At each point vegetation height was measured with a rangefinder (Ranging Opti-meter 120), and the habitat was classified in one of our habitat categories. Each point count lasted 15 minutes, during which all the bird species observed or heard within a radius of 25 m (an area of approximately 0.2 ha) were recorded. Altogether 153 point counts were done in forest (69 in 1997, 84 in 1998), 25 in forest edge (15 in 1997, 10 in 1998) and 23 in wet bush (21 in 1997, 2 in 1998). All point counts were carried out by the same observer (LB).

We used Mann-Whitney tests to compare the number of species seen per point count in the two years of the survey. Only forest and forest edge habitats were compared, as too few counts for statistical comparison were carried out in the wet bush in 1998.

We categorised each bird species as forest-dependent (species which are likely to face extinction if forest habitats disappear, categories FF and F of Bennun *et al.* (1996)) or non-forest (species which are likely to survive if forest disappears, category f, or not listed, in Bennun *et al.* (1996)). The proportion of individuals made up by forest versus non-forest bird species in the different habitats in the two years was compared with chi-squared tests. Throughout this paper the species order and nomenclature follow Ornithological Sub-committee of the EANHS (1996).

Results

Mount Kulal avifauna

Ninety-five species of birds were observed during the survey (Table 2). The richest habitat was the wet bush (61 species), while forest edge (54) and forest interior (38) showed a progressive decrease in diversity. Dry bush and man-made habitats also had a low number of species (respectively 28 and 29), probably in consequence of the lower research effort spent in these habitats.

We recorded 21 species new for Bird Atlas square 26B (Lewis & Pomeroy 1989), but only five of these were forest species (Montane Nightjar *Caprimulgus poliocephalus*, Blackcap *Sylvia atricapilla*, Chiffchaff *Phylloscopus collybita*, Northern Puffback *Dryoscopus gambensis* and Sharpe's Starling *Cinnyricinclus sharpii*). Of the 60 species frequenting forest and forest edge habitats, 20 could be considered forest-dependent and 40 non-forest

according to Bennun *et al.* (1996). However, several species that are not forest-dependent elsewhere in Kenya appeared to be commoner, and probably bred in this habitat, at Mt Kulal, although usually in the glades or along forest edges. These included Red-fronted Tinkerbird *Pogoniulus pusillus*, Cardinal Woodpecker *Dendropicos fuscescens* (individuals of this species had white wing coverts and heavy barring above and were assigned to race *hemprichii*, not to the race *lepidus* that is known to live in forest habitats (Zimmerman *et al.* 1996)), Grey-backed Camaroptera *Camaroptera brachyura*, African Paradise Flycatcher *Terpsiphone viridis*, Tacazze Sunbird *Nectarinia tacazze*, Golden-winged Sunbird *Nectarinia reichenowi*, Yellow-bellied Waxbill *Estrilda quartinia* and Yellow-crowned Canary *Serinus canicollis*.

Mist-netting

Table 1 and 2 summarise the results of mist netting activity. Capture rates (Table 1) were usually higher in forest-edge and wet bush (sites 1,2,5) than in the forest (sites 3,4,6). Table 3 compares the species caught at the two sites (3 and 5) where we ringed in both years of the survey. At both sites capture rates were higher but total number of species lower in 1997 than in 1998. In 1998, at site 5 there was a decrease in the number of Kulal White-eye and Common Bulbul *Pycnonotus barbatus*, while at site 3 we caught fewer White-starred Robin *Pogonocichla stellata*, Cabanis's Greenbul *Phyllastrephus cabanisi* and Olive Thrush *Turdus olivaceus*, but more Abyssinian Ground Thrushes *Zoothera piaggiae* and Common Bulbuls.

Considering the number of individuals captured, in 1997 forest-dependent and non-forest birds were respectively 44% and 56% of the total (n = 132) in wet bush sites and 83% and 17% in forest (n = 98); in 1998 the proportions were 13% and 87% in wet bush (n = 40) and 69% and 31% in forest (n = 138). These changes in proportions were statistically significant (χ^2 test, df = 1: wet bush, $P < 0.001$; forest $P < 0.02$), suggesting that forest birds moved towards the wet bush in the wet year 1997, while non-forest species penetrated the forest in the dry year 1998.

Table 4 reports the number and state of development of brood patches observed in the birds captured in 1997. No brood patch was recorded in 1998, suggesting that no breeding activity was occurring during our second year of survey.

Point counts

Table 2 shows the results of the point counts carried out in the forest, forest edge and wet bush. A higher number of species was observed in the forest, no doubt because of the higher number of point counts carried out in this habitat. Several species, including Common Bulbul, Olive Thrush, Kulal White-eye, Amethyst Sunbird *Nectarinia amethystina* and Eastern Double-collared Sunbird *Nectarinia mediocris*, were commoner in forest habitats in 1998 than in 1997. In the forest, a higher number of species/point count was

Table 1. Summary of mist-netting effort and results, 1997–1998

Year	Habitat	Site number	Date	Net-metre-hours	Birds caught[1]	Capture rate	Species caught
1997	Wet bush	2 & 5	26–27 & 29–30/11; 13–17/12	2190	132	60.3	19
1997	Forest edge	1	22–26/11; 11–12/12	3408	81	23.8	15
1997	Forest	3 & 4	1–5/12; 7–10/12	7787	98	12.6	15
1997	All	All		13385	311	23.2	30
1998	Wet bush	5	14–16/10	2040	40	19.6	17
1998	Forest	3 & 6	17–20/10; 25–28/10	9678	138	14.3	24
1998	All	All		11718	178	15.2	29

[1]Birds per 1000 metre-net-hours

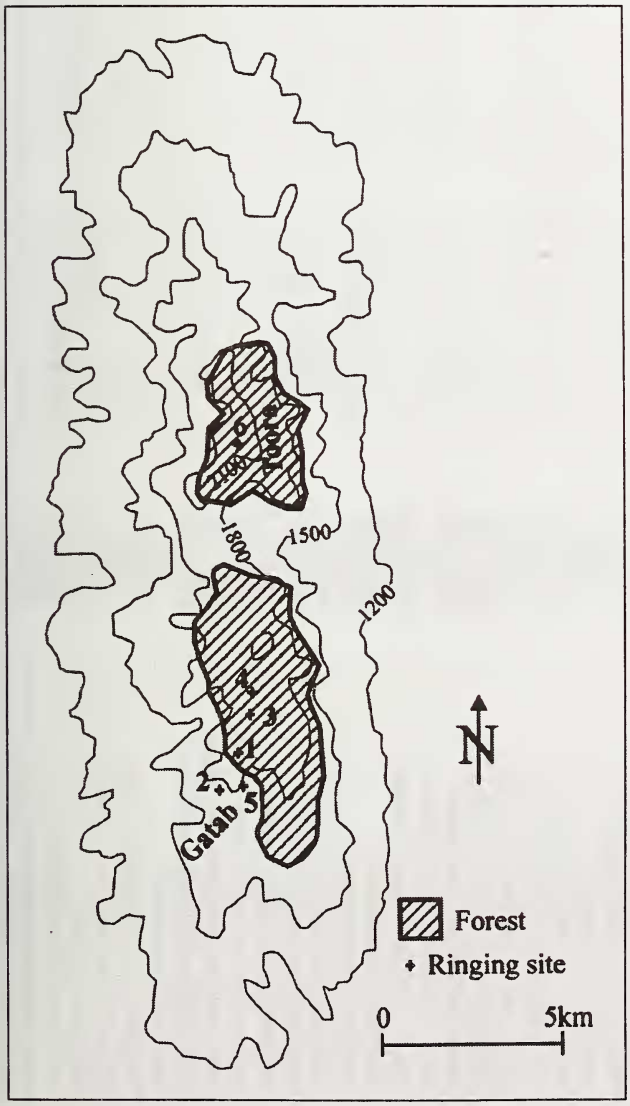

Figure 1. Map of the study area, showing the location of the six mist-netting sites.

Table 2. List of birds observed on Mt Kulal and the habitats where they were recorded. Figures without parentheses show capture rates (no. of individuals per 1000 net-metre-hours); those in parentheses are frequencies of point-count observation. Figures before the slash (/) are for 1997, those after it are for 1998. An asterisk (*) marks species that were present in that habitat but were not mist-netted nor recorded in any of the point counts

Species	Altitude range (m)	Forest	Forest edge	Wet bush	DB	MM	QSD
Black Kite *Milvus migrans*	1800			*	*	*	
Egyptian Vulture *Neophron percnopterus*	1800			*	*	*	
Hooded Vulture *Necrosyrtes monachus*	1800			*		*	
Bateleur *Terathopius ecaudatus*	1500–1800		*	*	*		
Gabar Goshawk *Micronisus gabar*	2100	– (–) / 0.10 (–)	*				
Mountain Buzzard *Buteo oreophilus*	1700–2200	*	*	*			
Augur Buzzard *B. augur*	1800			*			
Booted Eagle *Hieraaetus pennatus*	1700–1800		*	*			*
Lanner Falcon *Falco biarmicus*	1800			*			
Peregrine Falcon *F. peregrinus*	1800			*			
Crested Francolin *Francolinus sephaena*	1500–1700			*	*		
Yellow-necked Spurfowl *F. leucoscepus*	1700–1800			– (0.05) / – (–)	*		
Helmeted Guineafowl *Numida meleagris*	1800			*	*		
Emerald-spotted Dove *Turtur chalcospilos*	1500–1700			– (0.05) / – (–)	*		
Olive Pigeon *Columba arquatrix*	1800–2000	*	*				
Lemon Dove *Aplopelia larvata*	1800–2100	0.39 (0.06) / 0.62 (0.01)					
Dusky Turtle Dove *Streptopelia lugens*	1800–2000	– (0.03) / – (–)	*	*			*
Hartlaub's Turaco *Tauraco hartlaubi*	1700–2200	– (0.09) / – (0.06)	– (0.07) / – (–)	– (0.10) / – (–)			
Red-chested Cuckoo *Cuculus solitarius*	1800	*	*				
Klaas's Cuckoo *Chrysoccoccyx klaas*	1800–1900		*			*	*
White-browed Coucal *Centropus superciliosus*	1500–1800			*	*	*	
Montane Nightjar *Caprimulgus poliocephalus*	1800–2000			*		*	*
Nyanza Swift *Apus niansae*	1900		*				*
Mottled Swift *Apus aequatorialis*	1900		*				
Alpine Swift *Apus melba*	1900		*				*
Little Swift *Apus affinis*	1900		*				
Narina Trogon *Apaloderma narinae*	1800–2200	0.39 (0.01) / – (0.01)	*				
Eurasian Bee-eater *Merops apiaster*	1800		*				

Species	Altitude range (m)	Forest	Forest edge	Wet bush	DB	MM	QSD
Red-fronted Tinkerbird *Pogonolius pusillus*	1800–2100	– (0.03) / 0.10 (0.01)	0.29 (–) / – (0.20)	0.46 (–) / – (–)			
Spot-flanked Barbet *Tricholaema lacrimosa*	1700		– (0.07) / – (–)				*
Lesser Honeyguide *Indicator minor*	1900–2100	– (–) / 0.10 (–)	0.29 (–) / – (–)				
Nubian Woodpecker *Campethera nubica*	1800			*			
Cardinal Woodpecker *Dendropicos fuscescens*	1900–2000	0.13 (–) / – (–)	*				
Red-rumped Swallow *Hirundo daurica*	1800–1900		*	*			
Rock Martin *Hirundo fuligula*	1800–1900		*	0.46 (–) / 0.49 (–)		*	
Grey Wagtail *Motacilla cinerea*	1900	– (0.01) / – (–)					*
Yellow Wagtail *Motacilla flava*	2100		*				
Long-billed Pipit *Anthus similis*	1900					*	
Tree Pipit *Anthus trivialis*	1800–2100	– (–) / 0.21 (0.02)	*	*		*	
Cabanis's Greenbul *Phyllastrephus cabanisi*	1800–2200	2.83 (0.19) / 0.72 (0.24)	*				
Northern Brownbul *P. strepitans*	1800			– (–) / 1.47 (–)			*
Common Bulbul *Pycnonotus barbatus*	1500–2100	– (0.01) / 1.14 (0.17)	0.59 (0.33) / – (0.50)	11.87 (0.24) / 3.43 (–)	*	*	
African Hill Babbler *Pseudoalcippe abyssinica*	1900–2200	– (0.04) / 0.10 (0.11)					
Rufous Chatterer *Turdoides rubiginosus*	1500–1800			5.02 (0.10) / – (–)	*	*	
White-starred Robin *Pogonocichla stellata*	1700–2200	2.44 (0.19) / 1.76 (0.15)	0.29 (0.07) / – (0.10)	*			
Cape Robin-Chat *Cossypha caffra*	1700–2100	0.39 (0.10) / 0.31 (0.02)	1.47 (0.40) / – (0.10)	– (0.10) / 3.43 (–)		*	
Nightingale *Luscinia luscinia*	1800			0.46 (–) / – (–)			*
Sprosser *Luscinia megarhynchos*	1800			0.46 (–) / – (–)			*
Northern Wheatear *Oenanthe oenanthe*	1800–2100	– (–) / 0.21 (–)	*			*	
Pied Wheatear *O. pleschanka*	2000					*	
Abyssinian Black Wheatear *O. lugubris*	2000			*		*	
Common Rock Thrush *Monticola saxatilis*	2000			*		*	
Little Rock Thrush *Monticola rufocinereus*	1500–1900		– (0.07) / – (–)	0.46 (0.05) / – (–)	*		
Olive Thrush *Turdus olivaceus*	1700–2200	2.44 (0.30) / 0.83 (0.52)	3.23 (0.20) / – (0.30)	2.28 (0.05) / 0.49 (–)		*	
Abyssinian Ground Thrush *Zoothera piaggiae*	1900–2200	0.26 (0.07) / 1.34 (0.07)	*	– (–) / 0.49 (–)			
Spotted Flycatcher *Muscicapa striata*	1800–2000		*	*			
African Grey Flycatcher *Bradornis microrhynchus*	1500–2200	– (–) / – (0.01)	*	*	*		
Blackcap *Sylvia atricapilla*	1500–2100	– (–) / 0.21 (–)	0.59 (–) / – (–)	0.46 (–) / – (–)	*		*
Chiffchaff *Phylloscopus collybita*	1900–2200	– (0.04) / – (–)					*
Willow Warbler *Phylloscopus trochilus*	1700	– (–) / – (0.01)		– (0.05) / – (–)			
Brown Woodland Warbler *P. umbrovirens*	1700–2200	0.77 (0.59) / 0.93 (0.52)	4.11 (0.53) / – (0.30)	0.46 (0.05) / 0.49 (–)			
Boran Cisticola *Cisticola bodessa*	1500–1800			– (0.14) / – (–)	*	*	

Table 2. Continued.

Species	Altitude range (m)	Forest	Forest edge	Wet bush	DB	MM	QSD
Grey Wren-warbler *Calamonastes simplex*	1500–1600				*		
Grey-backed Camaroptera *Camaroptera brachyura*	1500–2200	0.51 (0.36) / 0.52 (0.24)	2.64 (0.93) / – (0.80)	6.39 (0.76) / 5.39 (–)	*	*	
Abyssinian White-eye *Zosterops abyssinicus*	1700–2100	– (–) / 0.21 (0.01)	*	*	*		*
Kulal White-eye *Z. kulalensis*	1500–2200	0.77 (0.23) / 1.45 (0.71)	5.28 (0.20) / – (0.70)	23.29 (0.19) / 0.49 (–)			
White-bellied Tit *Parus albiventris*	2000		*				
Paradise Flycatcher *Terpsiphone viridis*	1800–2200	0.51 (0.06) / 0.21 (0.13)	1.17 (–) / – (0.10)	0.46 (–) / 0.49 (–)			
Common Fiscal *Lanius collaris*	1800–1900					*	
Brubru *Nilaus afer*	1500				*		
Three-streaked Tchagra *Tchagra jamesi*	1800			0.46 (0.05) / – (–)			
Tropical Boubou *Laniarius aethiopicus*	1800–2100	0.26 (0.04) / – (0.12)	1.47 (0.07) / – (–)	0.91 (0.05) / 0.49 (–)		*	
Slate-coloured Boubou *L. funebris*	1500–2000		– (0.40) / – (–)	2.28 (0.38) / 0.49 (–)	*	*	
Northern Puffback *Dryoscopus gambensis*	1700–2100	– (0.07) / 0.10 (0.02)	0.59 (0.33) / – (–)	– (–) / 0.49 (–)			*
Pied Crow *Corvus albus*	1500–2100			*	*	*	
Fan-tailed Raven *Corvus rhipidurus*	1500–2100			*	*	*	
Red-winged Starling *Onychognathus morio*	1800–2100		*	*		*	
Sharpe's Starling *Cinnyricinclus sharpii*	1800	*					*
Amethyst Sunbird *N. amethystina*	1800–2200	– (–) / 0.31 (0.12)	– (0.13) / – (–)	0.91 (0.14) / 0.49 (–)	*	*	
Hunter's Sunbird *Nectarinia hunteri*	1500–1700			– (0.05) / – (–)	*		
Variable Sunbird *N. venusta*	1500–1800		– (0.13) / – (–)	– (0.33) / – (–)	*		
Eastern Double-collared Sb. *N. mediocris*	1800–2200	0.13 (0.13) / 1.76 (0.36)	0.88 (0.07) / – (–)	– (0.05) / – (–)		*	
Marico Sunbird *N. mariquensis*	1800			*			
Beautiful Sunbird *N. pulchella*	1800			0.46 (–) / – (–)			*
Shining Sunbird *N. habessinica*	1900–2000		*				
Tacazze Sunbird *N. tacazze*	2000	– (–) / – (0.01)	*				*
Golden-winged Sunbird *N. reichenowi*	2000–2200	– (–) / – (0.02)	*				
Yellow-spotted Petronia *Petronia pyrgita*	1500–1800			*	*	*	
Baglafecht Weaver *Ploceus baglafecht*	1600–2200	0.39 (0.04) / 0.41 (0.08)	0.88 (0.20) / – (–)	1.83 (–) / 0.49 (–)	*	*	
Vitelline Masked weaver *P. velatus*	1700–1800			– (–) / 0.49 (–)			
Red-headed weaver *Anaplectes rubriceps*	1600				*		
Yellow-bellied Waxbill *Estrilda quartinia*	1900–2200	– (–) / 0.62 (0.04)	*				
Purple Grenadier *Uraeginthus iantinogaster*	1700–1800		– (0.07) / – (–)	0.91 (–) / – (–)		*	*
Yellow-crowned Canary *Serinus canicollis*	2100		*				*
Stripe-breasted Seedeater *S. striatipectus*	1500–1700				*		*

Table 3. Comparison of the results of mist-netting at sites 3 and 5 in 1997 and 1998

	Site 3 (forest)		Site 5 (wet bush)	
Species	**97**	**98**	**97**	**98**
Cabanis's Greenbul	14	3	0	0
Common Bulbul	0	11	14	7
White-starred Robin	12	3	0	0
Olive Thrush	10	2	0	1
Abyssinian Ground Thrush	2	10	0	1
Brown Woodland Warbler	4	4	1	1
Grey-backed Camaroptera	3	3	8	11
Kulal White-eye	6	9	45	1
Total no. of individuals	69	56	77	40
No. of species	15	16	11	16
Capture rate (per 1000 mh)	15.5	10.9	60.5	19.6

Table 4. Number and extent of development of brood patches recorded in 1997

	Brood patch score				
Species	**0**	**1**	**2**	**3**	**% ≥1**
Slate-coloured Boubou	1	2	1	1	80
Rufous Chatterer	3	0	2	3	63
Red-fronted Tinkerbird	1	1	0	0	50
Purple Grenadier	1	0	0	1	50
Cape Robin-Chat	5	0	0	3	38
Grey-backed Camaroptera	16	4	4	1	36
Baglafecht Weaver	6	1	0	1	25
Kulal White-eye	55	13	4	0	24
Brown Woodland Warbler	17	4	0	0	19
Cabanis's Greenbul	19	3	0	0	14
Common Bulbul	21	1	1	1	13
Tropical Boubou	7	1	0	0	13
Olive Thrush	29	3	1	0	12
African Paradise Flycatcher	8	1	0	0	11
Total	**236**	**34**	**13**	**11**	**20**

observed in 1998 (mean 3.7 ± 2.2 s.d.) than in 1997 (2.2 ± 1.5). This difference was statistically significant (Mann-Whitney test, $U = 1341.5$, $P < 0.0001$).

At forest edges, the number of species/point count was higher in 1997 (mean 4.2 ± 1.8) than in 1998 (3.1 ± 1.4), but the difference was not significant (Mann-Whitney test, $U = 42.5$, $P = 0.15$), perhaps owing to the smaller number of point counts carried out in this habitat. Unlike most other species, Kulal White-eye was commoner in this habitat in 1998 than in 1997.

In forest habitats, proportions of individuals of forest-dependent and non-forest species observed during point counts were respectively 75% and 25% in 1997 (n = 188) and 73% and 27% in 1998 (n = 321). In forest edge habitats,

percentages were 34% and 65% in 1997 (n = 31) and 45% and 55% in 1998 (n = 62). There was no difference between the two years in the proportion of forest-dependent and non-forest individuals in either habitat (χ^2 test: forest, P = 0.66; forest edge, P = 0.31). This suggests that the numerical increase of non-forest species in forest habitats in 1998 was paralleled by that of several forest-dependent species (such as Kulal White-eye, Eastern Double-collared Sunbird and Olive Thrush) that had moved to the wet bush in 1997.

Discussion

As Moreau (1966) pointed, Mt Kulal has probably never been connected with other forest blocks in East Africa. Its avifauna must have reached it by crossing substantial expanses of hostile dry habitats. As a result, its bird community is clearly depauperate. We found only 60 species (Table 2) in forest and forest edges at Mt Kulal, a much lower number than in similar forests in central Kenya, such as the Mau (129 species) or the Aberdares (97) (Bennun & Waiyaki 1993). We do not think that the difference is just due to insufficient ornithological coverage: our survey, despite 42 days of field work, provided only five new records of true forest species for atlas square 26B (Lewis & Pomeroy 1989).

Perhaps because of the general paucity of forest species, several non-forest birds have been able to penetrate in the forest, where they may be able to exploit empty ecological niches.

Diamond & Keith (1980) surveyed the avifauna of Mt Kulal and discussed it in terms of island biogeography (MacArthur & Wilson 1967). They stressed that an isolated patch of forest has many similarities with an oceanic island, and probably experiences repeated extinctions and immigrations in its avifauna. They suggested that one species, African Hill Babbler *Pseudoalcippe abyssinica*, could be an example of an extinction at Kulal, as it was observed during their first visit in 1962 but not in the second in 1979. However, this species can be difficult to detect during a short survey. Having observed it during both periods of our survey we doubt that it had gone extinct and only recolonised the mountain recently.

Diamond & Keith (1980) recorded two forest species that we did not find, namely Crowned Hornbill *Tockus alboterminatus* and Collared Sunbird *Anthreptes collaris*. This is puzzling, as both are easy to detect when present. Possibly they have indeed gone extinct on Kulal. On the other hand, it is not surprising that with our longer survey we observed several species not recorded by Diamond & Keith (1980). Possible extinction and colonisation of bird species on Mt Kulal should be assessed with a much longer and more detailed survey; the present data are inadequate.

Mist-netting and point counts showed marked differences in the structure of the forest bird community in the two years. In 1998 we caught fewer birds in mist nets but located more during point counts than in 1997. However, both mist-netting and point counts indicated that the forest was more

species-rich in 1998 than in 1997. We believe that these results can be explained by the strong climatic differences in the two years when our survey was carried out. Both the forest and the surrounding habitats were much drier in 1998 than in 1997. A large number of individuals (of both forest-dependent and non-forest species) that had frequented the wet bush in 1997 appeared to move into the deeper forest in 1998, increasing the species richness of this habitat. Moreover, in 1997 many birds seemed to forage on the forest floor and among the shrubs and were easily mist-netted, while in 1998 they mostly shifted towards higher levels, in the tree canopy, where large amounts of wild fruit were available (L. Borghesio, unpubl. data). Here of course they would be out of the reach of mist-nets. The higher proportion of non-forest species in forest habitats indicated by mist-netting in 1998 should be interpreted cautiously, since the shift of micro-habitat selection must have biased the captures. Mist netting data seem also to show that forest-dependent species make use of non-forested (wet bush) habitats in the wet season. Changes in the bird community of forest edges are less clear, but point count data agree with the pattern found in other habitats (in the dry season non-forest species increased and forest-dependent species shifted towards the forest interior).

Breeding also appeared to be strongly seasonal. Many birds with brood-patches were caught during the wet season in 1997, but none in 1998. Moreover, active nests of several species were observed in November-December 1997, but none in October–November 1998.

Finally, Diamond & Keith (1980) reported that the conservation status of Mt Kulal was worrying, since the regeneration of forest trees looked sparse and unlikely to maintain the forest in the future. Based largely on this statement and on its very restricted distribution, Collar *et al.* (1994) classified the endemic Kulal White-eye as a Critically Endangered Species. Our data do not allow a precise assessment of the conservation status of Mt Kulal's avifauna. However, our observations show that 20 years after the survey of Diamond & Keith neither the bird fauna nor the extent of the forest have changed greatly. Human presence in the area is increasing, as is the exploitation of forest resources. However, human impact on the area is still limited, at present, to occasional opening of gaps in the canopy due to felling of single trees. This appears not to have a severe impact on the structure of the forest, at least for the time being.

During our survey, Kulal White-eye was the bird species most commonly captured, and one of those most frequently observed. This suggests that its population is likely to be quite large, and probably not in severe danger at the moment. Based on these findings, BirdLife International (2000) have reclassified this species as Vulnerable. However, the data show that Kulal White-eye shifts its habitat selection markedly depending on the season. During the wet season it frequents the evergreen bush outside the forest, indicating that its security depends on the conservation of this habitat as well as the forest.

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